Dementia and Activities of Daily Living

A Report on Technologies and Environmental Design that can Assist People with Alzheimer Disease and Related Dementias

Ministry of Community and Social Services

Ontario

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The firms mentioned in association with specific technologies in this report do not represent an exhaustive list of resources. Reference to specific devices or companies does not constitute an endorsement by the Ministry of Community and Social Services.

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Background

Alzheimer Disease and Related Dementias: A Growing Concern

Alzheimer Disease and related dementias largely affect older individuals and are a growing social and health concern. Estimates of the prevalence of these diseases indicate that 4.6 percent of persons over the age of 65 suffer from severe dementia while an additional 10 percent have mild to moderate dementia. Alzheimer Disease is estimated to account for over 50 percent of all cases of dementia among the aged.[1]

Changing demographics mean an increasing number of people are at risk of developing dementia — and of requiring care. (There are approximately 1,007,300 individuals aged 65 years or older living in Ontario today. This number is projected to increase by 50 percent by the year 2001. The segment 85 years and older is growing fastest and is expected to increase 110 percent by the same year.)

There are very few diseases which have such a profound impact on society, the individuals affected and their circle of friends as dementia. The burden of the disease extends beyond the experience of the victim and directly affects the family and other caregivers. The devastation that is associated with Alzheimer Disease and related dementias comes from the progressive loss of self and independence. The disease affects the individual's ability to carry out activities of daily living by impairing critical cognitive functions. As these functions deteriorate the burden on caregivers increases. Caregivers — either in the home, community programs or in the institution — must take over the individual's responsibilities for even the most basic activities of daily living.

1 Looking Ahead: Trends and Implications in the Social Environment, Ministry of Community and Social Services, March 1989.

Purpose of This Document

This report looks specifically at the ways in which technology and environmental design can be used to assist persons with Alzheimer Disease and related dementias with activities of daily living. It is the product of an extensive literature search as well as interviews with leading clinicians, technologists and researchers.

For purposes of this report, technology has been defined as any assistive device, physical design or systematic behaviour management technique that can be used to help either the caregiver or the individual who has dementia with specific activities of daily living. This definition provides a wide scope and includes both "low" and "high tech" technologies. Most of the technologies identified in this document can be classified as "low tech."

During the study it became apparent that little attention has been focused on the role of technology and environmental design in the management of dementia. One of the reasons for this lack of focus has been the confusion around how dementia affects the individual.

The Effect on the Individual of Alzheimer Disease and Related Dementias

Dementias that are the result of a disease process (such as Alzheimer Disease) are a group of cognitive disorders in which there is deterioration of brain structures and specific functions — such as language, memory or visual-spatial abilities — leading to dependency in activities of daily living.

What exactly is a cognitive disorder? The word cognition means the ability of the brain to process, store, retrieve and manipulate information to solve problems. After receiving a message, the brain interprets it and then responds by enabling a person to speak, behave and show emotions. A breakdown in brain structures will, therefore, affect cognitive functions.

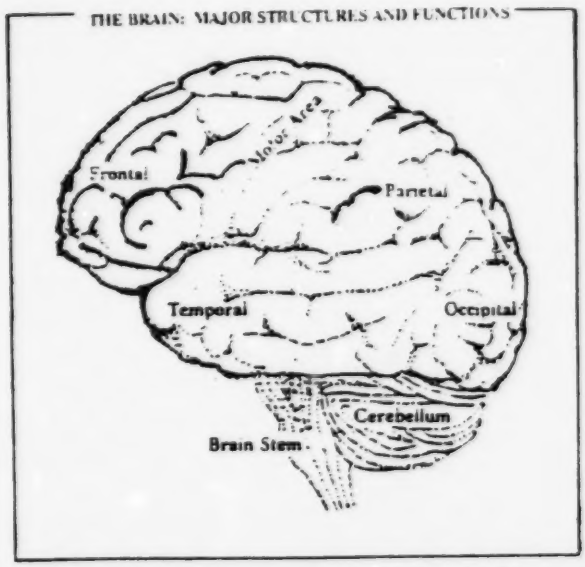
The cortex, where most of the higher mental functions occur, is the largest part of the brain and is divided into four "lobes," each of which has specialized functions. Figure 1 (on page 3) shows a graphic representation of the brain outlining the different lobes and a few of their main functions. The cortex is divided into two hemispheres which appear to be mirror images of each other. Their functions, however, are quite different. The left hemisphere usually controls verbal functions (speaking, writing, reading, calculating),

while the right hemisphere generally controls visual-spatial functions (visual, memory, copying, drawing, rhythm).

A synonym for cortex is "association area." If a patient has cortical damage to the left occipital lobe, for example, he/she may develop a cognitive disorder called "alexia" (inability to read). With such a cognitive deficit, if a person is given the word "apple" to read, he/she will be unable to make the "associations" needed to give meaning to these letters (i.e. that it can be red or green, that it is hard, that it is a fruit and that it grows on a tree). This breakdown in "association" occurs even if vision is intact. If the same person uses a different modality like the sensory cortex which is in the parietal lobe and is asked to "touch" the different letters, he/she will immediately make the required associations and say that the symbols he/she is touching represent an apple.

Interventions serve to reduce functional deficits by maximizing the intact, functioning portions of the intellect and bypassing the im-

FIGURE 1



Frontal Lobe:	control of emotions, motivation, expressive language, inhibition of impulses, motor integration
Temporal Lobe:	memory
Parietal Lobe:	sensation, awareness of spatial relationships
Occipital Lobe:	visual perception
Cerebellum:	co-ordination of movement
Brain Stem:	alertness and basic bodily functions (i.e., respiration)

paired functions. Knowledge of impaired, as well as intact cognitive functions, is therefore, very important in the design of appropriate treatment programs for brain-damaged individuals.

Some dementias may be reversible depending on their cause and their association with other factors such as depression. However, the majority of dementias including Alzheimer Disease are irreversible and progressive disorders. Although reports vary, it is estimated that dementia of the Alzheimer type comprises about 50% of the progressive dementias in the elderly. (The remainder of the cases of progressive dementia are accounted for by multi-infarct dementia {20%}, subcortical dementias such as Parkinson's, Huntington's, Wilson's disease {20%}, a combination of Alzheimer Disease and multi-infarct dementia or other neurological conditions {10%} [Ridder, 1985]. For the classifications of dementia and the characteristics of cortical and subcortical dementias, see the Appendix, page 79.)

Alzheimer Disease and related dementias have an insidious onset. In the early stages of Alzheimer Disease, the disorder usually begins gradually with impairment of memory for recent events. As the memory disorder progresses, disorientation eventually occurs. There are increased difficulties with language (aphasia), abstract thinking, judgment, and perception. In the later stages, the individual may have difficulty recognizing his own face in the mirror, or the faces of people he/she has known (prosopagnosia), or he/she may be unable to recognize simple everyday objects (visual agnosia). Repetitive continuous motions (perseveration) such as chewing, tapping, and walking/wandering then become more apparent. At this later stage of the disease, safety becomes a major concern. Motor functions are usually spared until the late stages of the disease.

Unfortunately, progressive dementias do not yet have a cure which will prevent or arrest the underlying pathological processes. There are a variety of approaches, nevertheless, which can assist the person to live through the course of the disease with comfort and dignity. These approaches range from treating the primary symptoms with drugs, to compensating for cognitive and motor deficits with assistive technology, behavioural interventions, and environmental adjustments.

Treatment and intervention, therefore, depend on a clear understanding of the wide variety of cognitive disorders that accompany different dementing illnesses. Much of the literature presents a simple view of dementia lumping many diseases under the heading of Alzheimer Disease. It is important to understand that dementia can be caused by a variety of different diseases affecting various parts of

the brain. There is no single picture of an individual who has dementia. Without a more complex understanding of the specific areas of the brain affected by the various diseases it is difficult to plan appropriate interventions to assist the individual with activities of daily living. (It should be noted that other dementias — those not caused by Alzheimer Disease — affect cognitive functions in different ways and cognitive disorders, in turn, affect everyday behaviours in very different ways.)

In terms of treatment strategies and interventions, the major focus should be on functional deficits (such as the inability to locate one's room) and devising technologies, environmental adaptions or treatment modalities which will compensate for the cognitive impairment producing functional impairments.

How to Use This Document

The report is divided into two main sections: technologies and environmental design.

The section on technologies has been structured to provide an overview of how Alzheimer Disease and related dementias affect activities of daily living, followed by a review of technologies available to assist with specific activities of daily living. Tables listing technologies and the criteria for their appropriate use, their disadvantages and an assessment of their complexity and cost accompany each area of daily living. The scale for costs is as follows:

Negligible	below $25
Minimal	$25 to $150
Moderate	$150 to $,1000
Expensive	more than $1,000

This document also includes a section on environmental design which describes modifications that can be made to the environment to assist individuals with dementia — and their caregivers — with activities of daily living.

There may be some overlap or duplication between the two sections because it is often difficult to draw a dividing line between what is "technology" and what is an "environmental adaptation" since many environmental modifications use some form of technology.

Assistive Technology

Introduction*

Many of the technologies that are useful for someone with dementia were originally developed to assist the physically disabled or the frail elderly. The impact of dementia on activities of daily living is very similar to many "physical" diseases or conditions. When selecting a technology it is important to weigh its potential helpfulness against its intrusiveness. Most devices provide assistance without compromising the individual's dignity or freedom. However, some technologies, such as restraints, seriously restrict a person and may impair their quality of life.

Because Alzheimer Disease and other dementias impose significant limitations upon the individual, it is important for caregivers to be aware of the cognitive deficits and how they change as the disease progresses. When a person becomes agitated while attempting to carry out an activity of daily living, the first step is to understand the underlying reason why the individual is upset. Only then can the appropriate assistive device or behavioural technique be used to alleviate the frustration.

Behavioural Interventions

The effectiveness of assistive technology can often be undermined by behavioural problems. When various dementias have been diagnosed and profiles of cognitive functions delineated, caregivers often cannot cope with the behavioural problems. To be effective under these circumstances, assistive technology must be used in conjunction with behavioural management techniques.

Behavioural management is defined as an attempt to change the frequency, intensity, duration or location of specific problem behaviours or sets of behaviours through systematically varying antecedent stimuli or consequential events. It is much broader in scope than the traditional classical or operant conditioning approaches. It

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* It is recommended that all users read the section titled ***Background*** on page 1 and the one titled ***The Effect on the Individual of Alzheimer Disease and Related Dementias*** on page 2. These sections describe the relationship between dementia and activities of daily living which forms the basis for the subsequent analysis of specific technologies.

incorporates social variables as well as cognitive variables that help improve the individual's quality of life.

Behavioural techniques vary from the simple use of reminders to various memory training strategies and programs that orient the individual to reality. The type of technique used will depend upon the nature and degree of cognitive impairment. Systematic cueing (providing cues in the environment), for example, will be most appropriate for people with severe dementia whereas reality training will be most beneficial for those with mild dementia. General behavioural management guidelines emphasize avoiding confrontation, maximizing residual cognitive skills, and reducing the chance of failure.

Techniques used to increase appropriate behaviours include prompting (both visual and verbal) stimulus enhancement (ensuring that prompts are perceived correctly), and primary reinforcement (encouragement or reward). To decrease inappropriate behaviours, techniques involve extinction (ignoring the behaviour), correction (prompting the individual to restore the damage) and restriction (preventing access to an activity or item). Hussian and Davis (1985) make an excellent review of behavioural technology in their book, ***Responsive Care: Behavioural Interventions with Elderly Persons***.

It is important to think about techonlogical interventions for people with all types of dementia. In what follows, we have focused on Alzheimer Disease, the most common form of dementia, as a an example, and have discussed behavioural interventions to illustrate the potential of assistive technology.

Categories of Activities/Functions

The following pages will review assistive devices and behavioural interventions that can be used to compensate for difficulties in carrying out activities of daily living in the following seven functional areas:

- Personal Care
  - Toileting
  - Eating/drinking
  - Dressing
  - Bathing
- Domestic and Homemaking
  - Preparing food
  - Using an oven/stove
  - Cleaning house
  - Shopping
- Mobility and Agility
  - Walking indoors
  - Getting in/out bed/chairs
- Safety and Security
  - Operating an emergency response system
- Social and Recreational
- Physiological (grasping, carrying, holding)
- Cognitive/Psychological
  - Orientation
  - Perception
  - Memorizing/Remembering
  - Communication

Detailed references to specific technologies discussed in the text are outlined in the bibliography on page 69.

Personal Care Activities

Toileting

Incontinence is a significant problem with the cognitively impaired elderly (Brink et al., 1986) and is usually a multi-factorial problem. It is often caused by various chronic systematic disorders compounded by multiple drug regimes and cognitive deficits. Determining the appropriate intervention requires a review of the relevant cognitive factors which contribute to the condition.

In the early stages of Alzheimer Disease, the underlying problem may be an inability to locate the bathroom due to spatial disorientation. This is commonly observed in residents who have recently been admitted to an institution or who are spending some time in unfamiliar surroundings. In this case it is important to increase the visual cues to facilitate locating the bathroom. Placing a sign on the door with a picture of a toilet as well as a written sign which clearly indicates "toilet" makes the use of both non-verbal and verbal cues. A red light at the door or a brightly coloured awning above the door are also good visual cues. Some institutions have painted a bright coloured line on the floor near the washroom. Behavioural techniques such as reality orientation (showing the person the location of the bathroom and other rooms) and verbal prompting (e.g. "go down to the red light") are also helpful when individuals do not have severe dementia.

Another reason for incontinence is that the person may not be able to get to the washroom fast enough. This may be due to an inability to undress appropriately or because a specific motor problem like tremor makes undressing difficult. In either case, the use of easily-opened fasteners (e.g. velcro, snaps) plus training on how to use them, and easy to wear clothes (e.g. elasticized waistbands) can alleviate the problem.

Not being able to get to the toilet quickly enough may also be due to poor planning and sequencing abilities or to lack of motor co-ordination or to slowness. Providing a bedside commode or a urinal and bedpan will reduce the time in decision making or travel to the toilet. Difficulties with mobility in the washroom can be reduced with the use of an over the chair toilet, a raised toilet, grab bars or guard rails near the toilet.

The ultimate development for independent toileting — the "Clean 'n Dry" toilet — assists individuals with severely reduced mobility

and co-ordination. The unit incorporates an automatic toilet flusher, warm water bidet, and hot-air dryer, and it can be installed onto an existing standard toilet bowl.

As Alzheimer Disease progresses and the person becomes disoriented, incontinence may be due to an inability to recognize the sensation of fullness in the bladder. A portable eneuritic alarm may supply the biofeedback necessary to facilitate using a nearby commode. Establishment of a regular toileting schedule is very helpful in some situations.

In later stages of Alzheimer Disease, it may be impossible to train the individual and, therefore, preventive interventions are less effective. External equipment to manage urinary incontinence (such as products to absorb, collect, or obstruct urine flow) should then be used (Brink et al., 1986). Protective bedding (disposable or reusable underpads) and the use of adult incontinence pads or briefs will contain urine and protect bedding or clothing. Collecting devices will fit to the individual's anatomy externally, and funnel urine into a bag or bottle collecting system. For males, these devices consist of either a penile funnel attached to the body by straps or a penile condom usually attached by adhesive. Different types of condoms and different means of attachment (adhesive strips, self-adhesion) are available. For females, use of external devices are more complex. Three funnel designs are in use and consist of a cup-shaped device which is attached either by straps, suction, or adhesive.

Obstructing devices keep individuals dry by obstructing the urethra, which prevents urine from leaking out. Regular use of the toilet with release of the device empties the bladder. Tissue damage and urinary tract infections are possible complications, however, and the individuals experience some discomfort. Obstructing devices for men consist of a penile clamp and for women they are pessaries which are inserted into the vagina to provide support below the bladder and around the urethra. Artificial sphincters can be implanted to prevent urine outflow and inflatable silicone gel prostheses can be inserted to replace existing urethra. Additionally, there are three methods of catheter drainage: indwelling catheter, intermittent catheterization and, for men, exteranl condom catheter. A major drawback of catheter use is that urinary tract infections are common.

In addition to these management modalities several behavioural techniques can be useful at these late stages of Alzheimer Disease in order to make toileting time as non-threatening as possible. Restricting fluids at night or reducing fluid intake to 1500 cc (53 ounces) reduces the degree of incontinence. Verbal prompting to remind the

Table 1.1 — Toileting

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Inability to locate the washroom			
Spatial disorientation and/or perceptual deficits	**Visual Cues** **- red light at washroom door** **- awnings placed over door** **- sign on door with picture and verbal cueing** **- coloured line on floor to toilet**	Not suitable or useful for severely demented	negligible / simple
	Verbal Prompting		negligible / simple
	Reality Orientation		negligible / simple
Inability to reach the washroom fast enough			
Confusion in undressing; motor problems (tremor, psycho-motor slowing)	**Velcro fasteners, snaps**		negligible / simple
	Easy to wear clothing		negligible / simple
Motor problems (tremor, psychomotor slowing)	**Portable commodes**		minimal / moderate
	Commode chair		minimal-moderate / moderate
	Portable urinals		minimal / moderate
	Bedpans		negligible / simple
	Easy access to the washroom		variable / simple
Reduced mobility and balance — late stages AD	**Raised toilet seat**		minimal / moderate
	Grab bars		minimal / simple
	Guard rails		minimal / simple

Need assistance using the toilet *Reduced mobility and coordination*	**Clean 'n Dry toilet unit (USA)**	Being developed. Incorporates automatic flusher, warm water bidet, hot air drying (can be installed on a standard toilet bowl)	moderate-expensive / complex
	Over the toilet chair.		minimal / moderate
Inability to recognize the sensation of fullness *Reduced perception*	**Portable eneuritic alarm**	Preventive measure. Provides biofeedback to facilitate using a nearby commode	minimal / moderate
	Regular toileting schedule		negligible / simple
	Protective bedding (disposable or re-usable underpads)	More suitable for later stages of dementia	minimal / simple
	Adult incontinent pads/briefs	"	negligible
	Protective clothing	"	negligible ($10 - $20)
	Urine drainage bag Male: penile funnel or condom	Condoms may be molded or unmolded. Require straps, adhesive; urinary tract infections common; may leak or split	negligible / moderate
	Urine drainage bag Female: funnel (3 designs available) e.g. silicone cup (NASA)	Some discomfort. require straps, suction or adhesive; urinary tract infections common	negligible / moderate
	Penile clamp (male) Pessaries inserted into vagina for support (female)		negligible / moderate
	Artifical sphincters Inflatable gel prostheses	Replaces existing urethra	negligible / moderate
	Catheter 1. chronic indwelling 2. intermittent 3. external condom(males only)	Urinary tract infections are common. Requires an external drainage bag.	minimal / moderate
Reduced judgment or awareness	**Restriction of fluids at night; verbal prompting**	Recommended amount of fluids: 1500 cc	none / simple
	Identify a pattern of elimination		none / simple

person to go to the washroom, or taking them to the toilet every two hours, compensates for deficits in judgment or awareness. It is also important to identify a pattern of elimination in order to structure scheduled visits to the toilet.

Overall, most of the interventions to assist with toileting are relatively simple and the cost is minimal (under $100). They can be used in institutional as well as home settings. These assistive devices used in conjunction with behaviour techniques will maximize the individual's independence when there is a dementing illness.

Eating/Drinking

In the early stages of Alzheimer Disease, the main difficulty which arises is that the individual forgets to eat. At first, establishing regular meal times and verbal prompting are sufficient to overcome this problem. As the disease progresses, however, other eating difficulties arise. A loss of table manners and a loss of the ability to use a knife and fork may occur. There may also be problems with messiness due to co-ordination problems. When judgement and perception are also impaired, it is difficult to know how much liquid to pour into a glass or how much food will fit on a fork, and food spillage is common.

One suggestion is to use a bowl instead of a plate since the former is easier to manage. Using dishes that are a different colour from the placemat also helps compensate for perceptual deficits. Assistive devices to alleviate these difficulties include plate guards, non-slip placemats, suction cups on plates, and spill-proof cups. To help with co-ordination and motor problems like tremor, individuals can use utensils with built-up or rubber handles or combined knife/fork or spoon/fork. To compensate for reduced judgment, the temperature of foods should be controlled to avoid burns.

When sequencing is a problem, the person may have difficulty knowing which foods to eat or when they should be eaten (e.g. dessert after main course). Reducing the number of choices a person has to make will simplify the decision making process. If visual agnosia has developed, individuals may be unable to "recognize" foods or utensils even when vision is intact. As such, new foods would be confusing and should therefore be avoided. In addition, the number of foods that are on a person's plate at any one time should be monitored as numerous choices and various colours can add confusion. Condiments should be kept out of reach to prevent them from being used inappropriately (e.g. ketchup in coffee). (Beck et al., 1988; Mace et al., 1984.)

Table 1.2 — Eating and Drinking

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Refusal or inability to eat independently			
Severe confusion; loss of appetite	**Automatic feeding machine**	May be required for late stages of dementia	moderate / moderate
Dysphagia	**Feeding tubes**	"	moderate / simple
	thick liquids, semi-soft foods	"	
Impaired perception and/or judgment; poor coordination or tremor	**Plate guards** **spill proof cups** **suction cups on plates** **non-slip placemats**		minimal / simple
Tremor or spasticity of hands	**Book and loop strap to hold utensil**		minimal / simple
Tremor, limited grasp range	**Rubber spoon, weighted spoon or fork**		minimal / simple
Arthritic hands	**Built up handles on utensils**		minimal / simple
Confusion; disorientation; impaired perception and/or judgment	**Remove unnecessary cutlery**		none / simple
	Serve finger foods or bite-size pieces		none / simple
	Regular meal time and location		none / simple
Reduced judgment	**Control food temperature**		none / simple
	Put away inedibles		none / simple
	Limit food choices		none / simple
Inability to learn	**Don't introduce new foods**		none / simple

As the disease progresses, eating needs often change. With advancing Alzheimer Disease, some people are hyperactive and may require frequent meals. Hyperorality, chewing, or tasting whatever is available also occurs in the advanced stages. Combined with perceptual deficits and impaired judgment, these eating needs may result in a person with Alzheimer Disease eating inedible or toxic items. Thus, objects on the table should be kept to a minimum.

Later in the disease process, close monitoring of food intake is essential. Food often remains unchewed and unswallowed, and there is limited movement of the tongue muscles. Eventually individuals lose all interest in eating. Administering thick liquids and semi-soft foods is recommended to avoid choking problems. Feeding tubes or automatic feeding machines may have to be used when the dementia becomes this severe.

In summary, cognitive deficits involving judgment, perception and sequencing interfere with eating behaviour. In addition, motor difficulties and poor co-ordination cause problems with the mechanics of eating. The technologies available to assist with eating are simple and most are inexpensive. Behavioural interventions are based on compensating for the cognitive deficits in order to reduce confusion. All interventions can be used in the home or institutional settings.

Dressing

No complex assistive technologies exist to aid in dressing, but there are many simple interventions which compensate for cognitive impairments. Errors in judgment, such as wearing sandals on a rainy day, can be corrected with verbal prompting: individuals can be reminded of the weather and appropriate clothing suggested. Difficulty in reaching or locating clothes can be alleviated by lowering clothes hanger bars and by labelling drawers with the types of clothes they contain.

As the dementia progresses, dressing becomes more difficult. Sequencing difficulties can cause the individual to put the clothes on in the wrong order or to wear too many accessories. Reducing choices in colour and style, laying out clothes in the order they are to be put on and hanging appropriate accessories with the clothes is helpful.

Loss of memory or disorientation can cause problems with putting garments on or taking them off. Individuals may forget how to undo buttons or zippers and may not notice fasteners due to perceptual impairments. The use of velcro closures and simple, loose fitting pull-on clothing which can be worn reversed (e.g. T-Shirts, tube

Table 1.3 — Dressing

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Difficulty in dressing independently			
Confusion, impaired memory and comprehension	**Velcro fasteners, oversize straps**		negligible / simple
Reduced range of motion	**Zipper pulls**		negligible / simple
Reduced range of motion or coordination	**Dressing aids: sticks, stocking device, long handled shoe horn**		negligible / simple
Confusion, impaired memory for dressing	**Reversible clothes (tube socks, t-shirts, elasticized pants); loose fitting clothes**		minimal / simple
Perceptual deficits	**Contrasting colours — buttons, zippers**		negligible / simple
Tactile deficits	**Self-stick animal decals**	Matching decals are attached to coordinate clothing	negligible / simple
Confusion and impaired judgment	**Reduce choices in colour, style**		none / simple
	Arrange complete outfits on hanger		none / simple
Sequencing difficulties	**Lay out clothes in order to be put on**		none / simple
Incontinence (frequent washing)	**Wash & wear clothes**		negligible / simple
Confusion, impaired memory for dressing	**Slip on shoes, pull on garments**		negligible / simple

socks, elasticized pants) are recommended. The use of contrast in buttons also helps with perceptual deficits.

In later stages of Alzheimer Disease (when mobility becomes reduced) or for individuals with motor impairments, dressing aids such as zipper pulls, stocking devices and dressing sticks may be useful.

Bathing

Individuals with dementia often have difficulty getting in and out of the tub and washing and drying themselves. For example, an individual with Alzheimer Disease may be unable to get into the bathtub due to perceptual deficits in judging height or size of the tub, tremor or lack of motor co-ordination. Installing grab bars on the rim of the bathtub and on nearby walls wili help with balance and reduce anxiety. A padded transfer bathtub seat eliminates the need to make perceptual judgment and also compensates for motor deficits. If mobility is significantly impaired a hydraulic bath lift can be obtained at moderate cost ($500-$700).

The person in the early stages of Alzheimer Disease may need to be reminded to take a bath. Establishing a regular bathing routine and verbal prompts will help compensate for this problem. In later stages of the illness, implements should be arranged in the order they are to be used (e.g. soap, sponge, shampoo) to help with sequencing problems. To reduce confusion, only one task should be attempted at a time. Bathing devices which contain soap and sponge in one unit or long-handled brushes are helpful when co-ordination is impaired. Use of a shower caddy to store necessary items makes planning and decision making easier for the confused person.

Impaired judgment may result in forgetting which tap is hot or cold so taps should be labeled (e.g. paint the hot tap red). The temperature of the water should be controlled so that the person does not burn himself/herself either by lowering the temperature of the water heater or by attaching units which control water temperature to the taps. After bathing, a body air dryer may be preferable to towel drying if the individual has motor deficits. Although the cost of a body air dryer is moderate ($500-$1000), it promotes independence in bathing, thereby preserving dignity.

If someone with severe dementia is left alone to bathe, he or she may panic due to disorientation and visual agnosia. At this stage in the illness, individuals should be supervised when bathing. Locks should also be removed from the bathroom door to avoid having the individual locked inside. In addition, the use of bath or shower seats

Table 1.4 — Bathing

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Difficulty in bathing independently			
Perceptual deficits and reduced mobility / coordination	**Shower stool or bathub seat**	Not suitable for later stages of dementia and may not be safe to leave person unattended	minimal / simple
	Padded transfer seat	"	moderate / simple
	Grab bars on rim of tub & washroom wall non-slip materials	"	minimal / simple
Reduced range of motion	**Magic soaper — long handle with soap attached**		minimal / simple
	Air dryer for body	Has large enough air flow to dry entire body	moderate / moderate
Reduced mobility	**Hydraulic bath lift**	May be too complex for severely demented person	moderate / complex
Need for protection from danger			
Reduced judgment	**Lower temperature of water heater**		none / simple
Confusion / disorientation	**Label taps hot and cold**	Paint hot water tap red	negligible / simple
	Remove lock on door	Locks can be de-activated rather than removed	none / simple
Need for organization			
Confusion / disorientation	**Regular routine to be followed**		none / simple
	Attempt one task at a time		none / simple
Impaired memory	**Shower caddy**	Stores shampoo, soap, etc.	minimal / simple
Sequencing difficulties	**Arrange implements in order of use**		none / simple

and non-slip materials in the tub increases safety and security when bathing.

On the whole, assistive technologies for use with bathing range from the most simple, inexpensive behavioural interventions to more expensive hydraulic lifts and body air dryers, but the majority of devices are easy to implement with minimal cost involved (under $100). Since bathing is a personal care activity which is usually carried out in private, these devices help preserve independence and dignity of the individual for as long as possible.

Domestic and Homemaking Activities

Preparing Food

To assist individuals who have difficulty sequencing and planning, meals should be simplified and limited to a few food types. Minimum preparation food systems (e.g. frozen dinners) or prepackaged freeze-dried meals will not overtax their cognitive abilities but still allow them some independence. Food timers can be used to assist with cooking, as long as the person is able to remember which food the timer was set for. Built-up handles with foam padding make it easier for individuals with motor problems to use utensils. One convenience item which should be avoided is the "boil-in-bag" type of food: these hot bags are difficult to handle and, because of their temperature, are a safety hazard.

Using An Oven or Stove

Safety is the main concern when individuals with cognitive impairments use a stove. Deteriorating memory skills combined with poor judgment can be very dangerous. To prevent any mishaps, various interventions should be implemented. The kitchen should be equipped with one of the new, small, lightweight fire extinguishers that are now available. Stoves with controls at the front of the appliance reduce the need to reach across the burners. Cooktops should be level with the counter to reduce the amount of lifting required. Installing a red reminder light on appliances will help cue individuals to turn them off. Even better are cooktops with automatic shut-offs.

When Alzheimer Disease or other dementia becomes more severe, cooking should not be permitted. A switch can be installed behind the stove to disconnect the burners and the knobs should be removed from the stove to prevent the confused person from using them. Removing the fuse or circuit breaker is also recommended.

Cleaning

Cleaning requires a relatively unimpaired level of cognition and, therefore, should not be attempted by individuals with severe

Table 2 — Domestic Activities

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Need for general assistance in cooking food			
Perception deficits; poor motor co-ordination; tremor	**Install stove next to sink**	Meal preparation should not be attempted by moderately to severely demented patients	none / simple
	Cooktop should be level with countertop		none / simple
Need for protection from danger			
Impaired memory and attention	**Stove — install switch in back to disconnect burners**	Memory disordered patients may forget altogether what they are cooking or timing	minimal / moderate
	Remove fuse or circuit breaker **Remove knobs**	"	none / simple
	Reminder light on appliances	"	minimal / moderate
	Food timers	"	minimal / moderate
	Automatic shut-off on stove	"	minimal / moderate
Inability to handle complex cooking tasks			
Inability to follow directions	**Pre-packaged, freeze-dried meals**	Boil in bag food should be avoided as it is too hot to be handled safely	minimal / simple-moderate
	Improved packaging for opening / sealing		minimal / simple
Inability to clean kitchen independently			
Reduced motor coordination and mobility	**Soil resistant surfaces**	Reduces cleaning requirements	moderate-expensive / simple
	Easily disassembled appliances **Small light-weight vacuum cleaners**	Minimizes bending and stooping	moderate / moderate
	Long handled dustpans	"	minimal / simple
Inability to shop independently			
Reduced mobility, weakness	**Wheeled cart**	More suitable for patients with mild cognitive deficits	minimal / moderate
	Powered cart	"	moderate / complex

dementia. When motor deficits are the main obstacle, however, technologies can make cleaning chores more manageable. Easily disassembled appliances minimize the physical force and activity required to clean and maintain them. Improved surfacing materials are easily cleaned and more resistant to soil thereby reducing the demands for heavy scrubbing. Small lightweight vacuum cleaners, central vacuuming units and long handled dustpans reduce the need for carrying and bending.

Shopping

Some assistive devices make it easier for individuals with mobility problems and motor deficits to shop. A wheeled cart used to carry goods from the car to the residence reduces the need to lift and carry. A powered passenger cart allows the person to shop outside the home without the use of a car. At a higher technological level, computer assisted shopping is currently being developed. Trintex videotex service will be a combination home shopping/information subscriber network which will require a personal computer and a local telephone. Such a service would only be useful to someone who has few cognitive impairments (i.e. some Parkinson's patients).

Mobility

Wandering

A behaviour that is a great concern in people with Alzheimer Disease or related dementias is wandering. The impaired person is endangered when she wanders out of the home or institution into busy streets or strange neighbourhoods. She may be disoriented and become frightened not knowing where she is. Since there are different reasons for wandering, identifying the underlying cause will help in managing the behaviour.

Wandering may result from searching and getting lost because the environment is new or because the individual is spatially disoriented. Interventions that compensate for disorientation are addressed in the section on Cognitive/Psychological activities.

A pocket card — a card with simple instructions such as "call home" written on it which the individual can carry in a pocket and refer to when lost — may help to help reduce anxiety in the lost person. Mildly confused people would benefit from this type of intervention since their ability to read and follow simple instructions is still intact. It is also recommended that the person wear an identification bracelet or necklace with his name, phone number, and the statement "memory impaired" on it.

In order to prevent wandering behaviour due to aimless searching, several interventions can be used to deter people. Mirrors or pictures can be placed on doors. Doors can be painted the same colour as the walls in order to camouflage them. Special door knobs or double door knobs are designed to be difficult for residents to manipulate thereby limiting their ability to leave. Enclosed space pathways allow movement and prevent dangerous wandering. If residents are not deterred by the more simple interventions, they may need closer monitoring. The use of Dutch/half bedroom doors or combination access codes on doors, will prevent residents from wandering when all else fails. In almost all cases, the use of restraints is inappropriate to manage wandering behaviour.

If deterrence or restraint are not feasible there are a number of technologies which can be used to monitor the whereabouts of wanderers. At a very simple level, residents in institutions can wear specially coloured T-shirts which alert staff that they are prone to wandering. Some institutions place a red tag on the back of a resident to identify the high risk wanderers. While these interventions may be

inexpensive and easy to administer, they do not contribute to maintaining the dignity of the resident. A less obtrusive measure is to install video cameras to monitor key areas or to install alarm systems to doors. The latter, however, may frighten or confuse residents. Portable alarms carried by staff may reduce the impact on residents.

If more sophistication is desired, there are several electrical detection devices available. Two examples are a transmitter tag which continually emits a signal to a tag detection unit and a transponder tag which also contains a receiver circuit. More simple passive tags simply contain a tuned circuit which is resonant at a fixed frequency. An institution using a moderately complex detection system will have to install tag detection devices at one or all door ways of an institution to indicate if a resident leaves. More complex systems can track up to 200 residents and differentiate them from each other or monitor two different zones simultaneously. Once a resident has been detected in a restricted zone, some type of action protocol must be taken. The cost for these systems starts at about $10,000.

Wandering may also occur because a person is agitated and needs exercise. Providing opportunities for walking either at home or within an institution or in structured exercise classes will alleviate this type of wandering behaviour.

In later stages of dementia, wandering behaviour is due to restlessness, especially at night or to perseverative behaviour (pacing and walking). Night wandering might be controlled with the use of a white noise machine which is designed to induce sleep and thereby reduce wandering (Young et al: 1988). However, this intervention is only in the experimental stage of design and its efficacy is not known.

Table 3 — Mobility

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Wandering *Disorientation, confusion*	Mirrors and pictures on doors		negligible / simple
	Painting door same colour as wall		minimal / simple
	Two-dimensional grid pattern near door	Not in use yet (experimental)	negligible / simple
	Enclosed space pathways	Built into building design, unobtrusive	n/a / simple
	Special shirts worn by high-risk wanderers		minimal / simple
	Special door knobs (double knobs)	Preventive measure	minimal / simple
	Dutch/half bedroom doors	Reduces person's dignity	moderate / simple
	Combination locks or codes for access		moderate / moderate
	Chimes, alarm systems connected to doors	May scare person, resulting in greater confusion	moderate / simple-moderate
	Video camera surveillance		moderate / moderate
	Body holders belts	Reduces person's dignity	minimal / simple-moderate
	ID bracelet	"	minimal / simple
	Red tag placed on person's back	"	minimal / simple
	Transmitter tag Transponder/transmitter tag		expensive / moderate
	Passive tag		minimal / simple-moderate
	Tag detection devices		expensive / complex
	Alert/control devices	Some units can track up to 200 people; many types available	moderate / complex
	Reality orientation	Not effective for moderately to severely demented people	none / simple
	Wall hanging over elevator buttons	Prevents individual from calling elevator	negligible / simple

Nocturnal wandering *Agitation and insomnia*	**Modified white noise to induce sleep**	Not proven effective. Some minimal reduction in wandering in some people (experimental)	moderate / simple-moderate
Inability to get in or out of chairs *Reduced mobility, coordination and strength*	**Cushion-lifting chair**	Mechanical or hydraulic	moderate / moderate
Inability to get out of bed *Reduced mobility, coordination and strength*	**Trapese device / grab bars**	Requires arm strength beyond many individuals' capability	minimal-moderate / simple
	Contoured bed / chair		expensive / moderate
	Raisable bed (upper part)	Moderately to severely demented person may not understand how to operate this device	expensive / moderate
Tendency to fall out of bed *Perceptual deficits, disorientation*	**Ambularm**	Device is strapped to leg and beeps when person's leg is over the edge of the bed	minimal / moderate

Getting In and Out of Bed/Chairs

Getting in and out of furniture is predominantly a problem for individuals with motor deficits. People with late stage Alzheimer Disease and sub-cortical dementia, with poor co-ordination and tremor have the most difficulty with this activity. Special chairs with mechanical or hydraulic mechanisms raise the cushion of the chair enabling the person to get up. Manipulating in and out of bed can be done with the help of grab bars, straps or slings, and trapeze-like devices. These all require a sufficient degree of arm strength and may be beyond the individual's capability. Beds that raise the upper part of the body are feasible for the elderly person with dementia. Another solution is to use a contoured bed/chair which is entered and exited like a chair but reclines for sleep.

Devices which assist with mobility in and out of beds or chairs can be moderate to expensive ($500 and above) and complex. While they may compensate for motor deficits such as reduced co-ordination, weakness, and tremor, they do not take cognitive deficits into consideration. Individuals with severe dementia may not understand how to work a hydraulic chair or bed or know how to get out of the chair or bed. However, these devices may be useful when operated by caregivers.

Safety and Security

People with Alzheimer Disease are less able to take responsibility for their own safety. Their ability to evaluate consequences becomes impaired and mistakes in judgment are common. Accidents can happen easily because people with Alzheimer Disease or related dementias forget so rapidly. Two types of intervention are useful to deal with safety issues: changing the environment to make it safer and installing emergency monitoring systems.

Altering the environment is a preventive approach which aims at removing objects that can cause problems, such as things that the person can trip over. Gates should be installed at the top of stairs. Hazardous substances (e.g. solvents, cleaning fluids) should be stored out of reach and medications should not be accessible. Fragile and unstable furniture should be replaced by sturdy and stable furniture. Bright reflector tape on handrails, door ways and sharp corners can help prevent falls due to misperception. Unsupervised smoking should not be allowed (Mace et al., 1981). Most of these interventions are particularly relevant to the home environment but they can also be used in institutional settings. (More detailed information on adaptations to the environment can be found in the next chapter.)

The most advanced monitoring system is home automation. The "Smart House" combines the centralized microprocessor control of building systems and household appliances with the unified distribution of power and communications. Building systems such as furnaces, air conditioners, and fire detection services and appliances such as stoves, televisions,stereos, and dishwashers would all be controlled by this central processor unit. Advances in wiring systems would allow preprogramming for turning appliances on or off, diagnosing malfunctioning appliances and systems, and sensing, controlling, and communicating information on lighting, heating, air quality or sound. One of the capabilities which is currently being developed in the Smart House is voice recognition in a two-way electronic emergency monitoring system. The system can recognize speech sounds and respond in ways for which it has been programmed. For example, if a person should fall or experience some other emergency when no one is present, the person need only say "help." The system would provide a programmed reply such as "shall I call the doctor?" The answer "yes" would cause the system to make the call, sending a prerecorded message.

Table 4 — Safety and Security

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Need for safety / security			
Perceptual deficits, disorientation	**Smart House voice recognition**	Not fully developed yet Not useful for more demented persons	expensive / complex
	Emergency alarm system	Not useful for more demented persons	expensive / complex
	Reduce size of windows (can't be crawled through)	Built into design of building	minimal-moderate / simple
	Remove objects person can trip over **Put gates on top of stairs** **Don't allow unsupervised smoking** **Store hazardous subatnces out of reach** **Remove unstable furniture**		negligible / simple

At a simpler level, individuals can wear a transmitter panic button which they must push when help is required. If they subscribe to a personal emergency response system, a radio signal is sent to a receiver unit attached to the subscriber's telephone. The home unit then seizes the telephone line, even if the phone is off the hook, and electronically dials the emergency response centre. Another feature of some emergency call units is a timer which automatically resets each time the subscriber uses the phone. If no calls are made after 12 or 24 hours, an emergency signal is sent to the response centre.

Some emergency call devices have a two-way voice communicator which includes a stationary transmitter-receiver unit which can dial the home telephone and relay distress signals, a pendent transmitter, and a hand-held transmitter which usually remains in the person's bathroom. The cost for this system is about $1,000 plus $15-$20 each month for the monitoring service.

Another technological device - the Ambularm - helps prevent falls out of bed. It attaches to the leg and emits an intermittent sound when the person swings a leg over the edge of the bed.

In summary, the technologies which respond to emergencies are fairly complex and can be costly. They are designed primarily for home use and for elderly people who are often alone. They have limited use for individuals with Alzheimer Disease because their memory and judgment deficits may keep them from remembering who to call or what to do. Given that Alzheimer Disease is progressive and cognitive functioning continues to deteriorate, it may not be cost-effective to invest in these devices.

Social and Recreational Activities

Socializing and recreational activities are important for people with dementia. Previously learned activities that are very familiar to the person may remain important but those which are new and too complex may have to be replaced by simpler joys. It is important to be aware of the person's capabilities and not to push them beyond their limits. Alternatives to watching television or reading (activities which may be too difficult for individuals with moderate to severe dementia) are experiencing the world through the senses: watching a beautiful sunset, smelling a flower, hearing a bird sing, or stroking a furry animal are all enjoyable experiences which should be brought to their attention.

There are many behavioural interventions which can promote social interaction. For example, the use of a buddy system, where individuals are paired off, facilitates closeness and stability. Verbal and visual prompts about upcoming activities serve to increase participation. Building in opportunities for interaction, such as a regular coffee hour, also encourages people to interact.

Environmental adaptations in institutions can also improve social interaction among individuals with dementia. Offering a range of social options from private spaces, spaces for dyads or intimacy, to family or classroom-sized spaces allows individuals to choose the degree of interaction they desire. Creating nooks in hallways allows residents to watch ongoing activity or have impromptu discussions without being in the way of regular hallway traffic. Arranging seating in the lounge area to accommodate small groups facilitates conversation and interaction.

Table 5 — Social/Recreational Activities

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Lack of social interaction			
Lack of initiative, reduced planning skills	**Range of social options: Private spaces, spaces for dyads, intimacy, family-sized groups, etc.**		Design costs / simple
	Opportunities for interaction built into daily activities (coffee hour)		none / simple
	Use of social cues (smiling, eye contact, greeting by name)		none / simple
	Use of a buddy system		none / simple
	Verbal prompts **Visual prompts**		none / simple

Physiological Activities

Reaching, grasping and carrying objects can be problematic for individuals with motor problems such as tremor or reduced co-ordination. Various technologies exist that facilitate these activities. Reacher/grabber sticks help to get items on high shelves. Two designs are available: a pistol grip reacher, which requires good hand and finger functioning, and the Swedish reacher which is preferable for weaker hands. The main disadvantages of reacher sticks are that they place a great demand on wrist strength and heavy items can't be retrieved. Add-on shelves which swing up or down, bypass this problem.

At a very high technological level, the ideal solution involves robotics. These are voice activated devices with two arms and grip devices capable of co-ordinated movement in three dimensions.

Technology to assist with grasping is, in contrast, very simple. Rubber grips or electronic jar opening devices and door knob adapters are examples of such devices. Plastic, rubber or foam can be slipped over handles to aid in gripping. A rolling cart can be used to transport items from one room to another. Use of plastic utensils, dishes and mixing bowls reduces the need for strength in carrying.

Table 6 — Physiological Activities

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Inability to grasp objects *Weakness, reduced coordination*	**Rubber grip**		negligible / simple
	Jar opener (positioning and opening)		minimal / moderate
	Doorknob adaptor		minimal / simple
	Plastic foam cover for handles		negligible-minimal / simple
	Tube winder (toothpaste, etc.)		minimal / simple
Inability to carry objects *Weakness, reduced co-ordination*	**Rolling cart**		minimal / simple-moderate
	Plastic bowls		minimal / simple
Inability to reach or hold objects *Reduced range of motion*	**Robotics**		expensive / complex
	Reachers: **1. Pistol grip** **2. Swedish reachers** **3. Add-on shelves which swing up and down**		minimal / moderate

Cognitive/Psychological Activities

Orientation

Poor recent memory causes many problems when providing care to people with Alzheimer Disease. In early stages of the disease, caregivers must work to alleviate time and spatial disorientation in conjunction with recent memory deficits. Since the person is still able to read and follow simple instructions the use of visual cues is most effective at this stage. A large calendar with the date clearly indicated, a large face analog clock, a daily schedule, and signs and decorations related to the season will all assist in orienting the person to time. A watch with very large numerals (e.g. "Wild Watch") can also be useful.

In terms of spatial orientation, reality training may be beneficial if the person is capable of comprehending and learning some new information. Colour coding different areas or having residents wear colour coded wrist bands which correspond to their room colour may be appropriate interventions. Some institutions have painted different coloured lines on the floors or walls to mark pathways to key areas. It is also useful to clearly label doors with what they represent. For activity rooms, a picture of the activity on the door (e.g. a place setting for the dining room) will assist the disoriented residents in locating the area they want. This idea can also be used to identify residents' rooms (i.e. using a sign with their name and photograph on it.)

When the dementia has progressed, it is difficult to alleviate disorientation. The best use of technology at later stages in the illness is with behavioural management. Maintaining regular daily routines, avoiding new or strange situations, and keeping familiar objects in the same place will help to reduce confusion or, at least, not accelerate it. Simplifying the environment by eliminating public address systems and keeping activities around the resident to a minimum is highly recommended.

Perception

Perceptual deficits in people with Alzheimer Disease cause them to have difficulty making sense of what they see. They often have problems identifying incoming stimuli and as a result their distorted perceptions can lead to illusions or delusions which in turn

elicit paranoid or aggressive responses. The technologies which alleviate misperceptions are not complex, yet they can decrease confusion significantly. Since perceptual deficits are present even at early stages of the disease and progressively worsen resulting in complete visual agnosia, the following interventions are suitable for any degree of Alzheimer Disease.

The use of contrast in the environment is strongly advocated in order to eliminate ambiguity. Different colours can be used for walls and floors in order to separate foreground from background. Similarly, colour can be used to differentiate place settings from table cloths, steps from the floor, and furniture from objects. Even doorknobs can be painted a different colour from doors to maximize a distinction. Equally as important, contrast should be eliminated when no change exists (i.e. floor patterns). For maximum effect, bright colours rather than pale pastels should be used. It should be noted, however, that people with severe dementia may lose their ability to recognize colour. In this case, multiple cueing using other sensory modalities (verbal, sensory) will help with recognition.

To maximize visual acuity it is important to increase lighting and ensure that it is distributed evenly to reduce glare. Carpeting the floors will also reduce glare. All strategic locations such as hallways, stairs and bathrooms should have lighting kept on during the night to assist the individual in orienting himself (Beck et al., 1988).

In general, ambiguity should be eliminated wherever possible. In late stages of dementia, individuals will lose the ability to recognize faces, even their own. When this happens, mirrors should be removed. Other potentially misleading stimuli such as art works which may be a source of delusions for the person with dementia should also be removed.

Memorizing and Remembering

Loss of recent memory and failure to acquire new information is the first and most significant symptom to appear in Alzheimer Disease. Existing approaches to memory remediation advocate practice and exercise drills. The literature indicates that people with memory impairments may learn some specific pieces of information through repeated practice but they do not have improved memory for any other materials (Glisky et al., 1986). Furthermore, the data suggest that people with Alzheimer Disease are relatively insensitive to encoding information, therefore reality training or simple repetition will have limited success (Tariot et al., 1985). Certain encoding conditions, however, can be enhanced to increase the chances that

Table 7 — Cognitive/Psychological Activities

Criteria for Use *Associated Deficits*	Technology / Intervention	Comments	Cost / Complexity
Difficulty with orientation			
Confusion, disorientation	Microprocessor / voice activated synthesis	Not available yet. Not really useful if peson can't follow directions	expensive / complex
	Coloured stripes on floors and walls to mark paths to important rooms / spaces		negligible-minimal / simple
	Label doors with extra large letters or pictures		negligible-minimal / simple
	Name and photo of person on room door		negligible-minimal / simple
	Colour cued locations, with colour coded wrist band to match person's room		negligible-minimal / simple
	Large print calendar		negligible-minimal / simple
	Large analog clock		negligible-minimal / simple
	Signs and decorations related to season		negligible-minimal / simple
	"Wild Watch" (very large numerals)	Brand name watch	minimal / simple
	Remove misleading stimuli (mirrors, artwork)	Perceptual deficits contribute to confusion	none / simple
	Reality orientation	Not effective for individuals who are severely demented	none / simple
	Lamps on at night	Helps prevent "sundown syndrome"	negligible / simple
Memory impairment, disorientation	Post schedule of daily activities in order of sequence		negligible / simple
	Maintain consistent routine Simplify the environment Minimize confusion / distraction Keep familiar objects in the same place Avoid new or strange situations		none / simple

Need for assistance with perception			
Confusion due to reduced perceptual skills	**Use contrast: Separate foreground from background / walls from floors Dark door knobs on light doors place settings different from table cloth distinguish steps from floors or furniture**	Prevents confusion or catastrophic reactions	minimal / simple
	Eliminate contrast when no change exists (e.g. different patterns on floors)	"	minimal / simple
	Carpet floors to reduce glare	"	moderate / simple
	Increase lighting & distribute evenly	"	moderate / simple
	Use bright colours	Loses effectiveness in severe dementia	negligible / simple
	Remove mirrors and traditional art	Prevents confusion	negligible / simple
Prosopagnosia	**Use other sensory cues**	Prevents confusion or catastrophic reactions	negligible / simple
Need for assistance with memory			
Impaired recent memory	**Make lists of daily activities Make notes**	Not effective for moderately to severely demented	negligible / simple
	Clock radio system	Reminds and controls Not effective for moderately to severly demented	minimal-moderate / moderate
	Electronic diary	Several different alarms can be programmed Not effective for moderately to severely demented	minimal / moderate
	Electronic alarms	Not effective for moderately to severely demented	minimal / moderate

material will be remembered. For example, the number and complexity of stimuli can be reduced by giving simple instructions or substituting pictures for words. The preservation of sufficient procedural memory (knowing how to do something) may permit limited rehabilitation in some people with Alzheimer Disease.

The use of external aids holds more promise in terms of memory remediation, especially for individuals in the early stages of Alzheimer Disease.

Storage devices such as diaries, notebooks and lists can compensate for some memory loss. Cueing devices such as alarm watches and bell timers are helpful for cooking and taking pills because they remind the individual to do something at a specific time. However, the elderly person may not recall what that action was.

Some electronic calculators with extra functions have alarms that can be set independently. There are pill dispensers that organize medications in compartments using lights and alarms to remind the person to take her/his medication. The only drawback is that the person must remember the relevance of each different alarm. Even with mild memory impairment such a task can be problematic. An electronic diary — the Esselte Electronic Diary — overcomes this problem by having an alarm connected to a daily calendar where all appointments can be recorded. When the alarm rings the person needs only to check the current time by looking at a clock and then refer to the diary to see what was supposed to be done. Another assistive device involves a clock-radio system which verbalizes reminders and automatically controls some appliances. Finally the environment can be structured to reduce memory load. Cupboards and drawers can be labelled and lists can be posted on walls.

In general, external memory aids are most useful in the early stages of dementia when intellect is mostly intact. As the person's health deteriorates these devices will have no meaning or use and may even be a source of confusion (e.g. ringing alarms).

Communication

Difficulties in understanding or communicating with people with Alzheimer Disease or related dementias are caused by two types of deficits: problems with self-expression and problems understanding information.

People with dementing illnesses may have trouble with self-expression, which varies from the occasional word finding problem (anomia) to the inability to verbally communicate any ideas at all (expressive aphasia). In these cases, it is helpful to supply the word

for the person or to try to guess at the idea they are trying to express. Using visual cues to augment verbal communication is also recommended (Mace & Rabins, 1984).

On the other hand, individuals with dementia may be able to express themselves but they may not be able to understand others (receptive aphasia). They may also have trouble understanding written information even though they are able to read letters or words. For example, a note posted in their room which says, "Your appointment is at 10:00 am" may not be acted upon because they cannot understand the meaning of the note. Thus it is important to bear in mind that reading and understanding are not the same skills (Mace & Rabins, 1981).

To improve verbal communication with a person who has Alzheimer Disease, short words and short, simple sentences should be used. Rather than saying "Don't forget to bring your raincoat because it might be cold and rainy later in the day", it is better to say "Bring your raincoat". It is also a good idea to only ask one, simple question at a time. Avoid complex choices like, ' Would you rather go to visit your son or your daughter or would you prefer to postpone family visits until the weekend?" If you repeat a question, always repeat it word for word, to avoid introducing new words or ideas. Keeping instructions limited to one task at a time is also helpful to the person with dementia. She may have trouble breaking down a complex task into individual steps and end up not doing the task at all. However, if the person is asked to do one step at a time, then there is much less room for confusion. Another point to keep in mind is that the mentally impaired person requires more time to process information. It is important to speak slowly and to allow enough time for the person to respond.

In addition to behavioral techniques, technological assistance for aphasics is available in the form of computer-aided visual communication. Researchers have developed software for persons with severe chronic aphasia which turns a standard Macintosh computer into a communicative assistive device (Steele, Weinrich, et al; 1988). There are four potential applications of this technology:

Dialogue facilitator. As a dialogue facilitator, the system can be used to support more accurate and expressive communication in language-impaired individuals. On the basis of informal observation and family reports it is used most effectively when conversations of some importance take place.

Aid for complex task execution. Pilot research on the use of the system to facilitate tasks such as cooking is promising. The complex

cognitive task of recipe preparation was simplified and rewritten into a series of serially ordered instructions which resulted in the successful preparation of four different recipes. Scientifically controlled studies are currently underway.

Aid for intersystemic reorganization. Intersystemic reorganization is a rehabilitation technique which utilizes a relatively unimpaired modality to provide support for improved performance in a relatively impaired modality (e.g. visual skills augmenting verbal skills). This idea requires further development and study, but it is promising as a rehabilitative tool.

Early therapeutic intervention. Speech therapy can be supplemented by computer activities in the early stages of language impairment. Individuals can initiate computer "therapy" at their own convenience and the computer can handle highly repetitive tasks accurately without boredom or irritability. However, as the dementing illness progresses, this type of intervention becomes too cognitively demanding to be used by the person.

Discussion

Assistive devices which help in the activities of daily living vary in complexity from very simple, basic devices to complicated, computerized systems. Practically speaking, it may not be cost effective to invest in expensive devices for home use for persons with Alzheimer Disease or other dementias because the time period during which they will be capable of utilizing the equipment varies from months to a few years, depending on their degree of cognitive impairment. Simple assistive devices used in conjunction with behavioural interventions will likely produce the best results in activities of daily living because they are easy to administer and can be modified to meet the needs of each individual person.

One additional point which needs to be stressed is that individuals should be assessed at regular intervals to monitor cognitive deterioration. Since the assistive technologies that will be effective are closely linked to the nature and degree of impairment, it is important that individuals with dementia are not pushed beyond their intellectual capabilities. A thorough, objective neuropsychological evaluation is strongly recommended in order that the person's strengths and weaknesses can be identified and clearly understood by the caregivers. A significant shortcoming of the literature on Alzheimer Disease is the lack of objective cognitive assessment. Very often, assessment tools are simplistic screening devices which yield a functionally meaningless composite score (e.g. Mini Mental State questionnaire) or a person's level of functioning is rated by an observer on a very crude scale (e.g. no impairment, moderate impairment, severe impairment). These types of assessments are inaccurate and provide very little information about spared and impaired cognitive functions. In the care of a person with a dementing illness this is unacceptable especially given the comprehensive nature of medical investigations for persons with dementia.

Environmental Design

Introduction

Environmental design is an important factor in maximizing quality of life for elderly persons with dementia. Information from the environment can facilitate or impede orientation, perception and memory. Mental impairment is not caused by environmental design, but problem behaviours may be exacerbated by inappropriate environments. In dementia a person's ability to relate to the environment is affected in very fundamental ways. Cues may be insufficient, unintelligible or too ambiguous for a cognitively impaired person to discern their meaning. Moreover, the person may also have sensory deficits (e.g. hearing, vision or tactile loss). Consequently, the individual's responses may appear maladaptive when, in reality, they are the most integrated responses possible on the basis of inadequate information. Designing an environment for the person with dementia involves reducing or adding stimuli which compensate for their deficits in order to minimize cognitive handicaps. A properly designed environment can enhance the ability of individuals with Alzheimer Disease and related dementias to function independently.

Lawton's environmental docility hypothesis suggests that the less competent the individual, the greater the extent to which the environment accounts for the individual's behaviour. As a result, low competence individuals are more subject to the negative effects of inappropriate or problematic environments than are high competence people. In a more positive vein, the theory implies that improvements in the environment will bring about a greater amount of improvement in the behaviour or feelings of less competent individuals than it will in more competent individuals.

Goals

The two major goals in developing environments for individuals with dementia are:

- the health and safety of all users
- helping people function at the maximum level of their ability, within the constraints that their mental and physical condition allow.

In a long-term care environment, there is a third goal:

- to develop an environment that is as home-like and non-institutional as possible.

The stage of the disease (mild, moderate or severe) and the abilities of the individual are more important in determining appropriate design than is the specific type of setting (home, Day Program, or long-term care facility). The environment must support the types of activities which will take place and the manner in which these activities occur.

Since people with Alzheimer Disease have the same needs as any other older adult, the goals for planning and designing an environment are the same as they would be for any older person. However, consideration must be given to the special needs of individuals with dementia — regardless of the type of environment being considered.

The information provided here distinguishes between environmental design issues which are important to all elderly people — regardless of cognitive function — and those which are of special importance to individuals with dementias. In this report, it is only possible to highlight some basic environmental features, and only some of the more basic aspects of each of them. The bibliography contains references that provide a more comprehensive understanding of designing for older people in general and for those with cognitive impairments.

General Environmental Elements for All Elderly People

General environmental features relevant to all elderly people include:

- Colour
- Use of contrast
- Signage and decoration to assist with way-finding
- Lighting and glare
- Flooring
- Furniture
- Personalizing space
- Noise
- Texture
- Smell.

For some of these features, the general guidelines for older adults are also appropriate for those with cognitive impairment; in other cases, the guidelines must be further adapted to meet the special needs of people with dementia.

Colour

Changes in the eye, including the yellowing of the lens, mean older people see colours differently. Pale colours appear washed out, while dark colours such as navy blue, black, maroon, dark green and dark brown appear muddy. Blues and greens appear similar to each other, and both may appear grey to some older adults. Red, yellow and orange are most easily seen, and are good colours to use as accent colours. However, one needs to be judicious in the excess use of strong colours in environments for the older adult.

Difficulties with colour perception, and a lack of familiarity with the concept of colour coding, mean that colour coding should never be used as a cue on its own, though it may be used in conjunction with other information systems. People with Alzheimer Disease and related dementias may initially be able to use colour as a cue, but will probably need to be constantly reminded that colour is a cue, and will also need to be reminded of the relevant colour for them. However,

as the disease progresses, they will become unable to use colour as a cue in way-finding.

Contrast

Heightened figure-ground contrast is an important environmental design feature which should be used to help compensate for decreased visual acuity in the elderly. Using light-dark contrast (as opposed to colour contrast) at edges which convey information will make the environment easier to comprehend, increasing users' safety and ability to function independently. Use contrast to call attention to the intersection of the wall and the floor, handrails and doors. Contrast is also important between tables and floors, between seats and floors, and at smaller scale environmental edges such as the plate against the tabletop, and handles on drawers and cupboards.

The appropriate use of contrast is particularly important for individuals with dementia, who may not only have visual problems but may have cognitive difficulties interpreting what they see. This is exacerbated by indications that people with Alzheimer Disease may have difficulty with depth perception and require additional assistance in separating figure from ground.

In certain instances, lack of contrast can be as important as contrast. Avoid contrast in flooring because it may be perceived as a change in the height of the floor. This often makes the individual frightened or reluctant to cross the colour change. If the type of flooring changes between spaces, use colours that are similar in tone to each other.

Camouflage can also be an important environmental modification. While it is often common to outline doors in order to draw visual attention to them, there are some doors (doors to clean and soiled utility rooms, doors to the medication room, doors to other spaces which may contain poisonous or dangerous materials, doors out of the area) which the person with Alzheimer Disease should not be using. These are best camouflaged by painting them the same colour as the surrounding wall.

Signage and Decoration

Both signage and decoration can be used effectively to assist with way-finding. Because different elderly users have different visual deficits, the way-finding system must use multiple cueing, in which several different cues are used to convey information, on the assumption that one of the cues will be effective for each user. A

variety of visual (e.g. colour, words, pictures, wall hangings, etc.) and non-visual (e.g. texture, smell) cues should be used wherever way-finding cues are provided.

Letters on signs should be simple, not stylized, and a minimum of 3/4" high; white letters on a black background are easier to read than the reverse.

Decoration to assist with way-finding may take the form of art work such as paintings, photographs and posters, or soft craft products such as quilts, hooked rugs and macrame. Three dimensional items such as clocks, aquariums, sculpture and plants may also be used as landmarks to assist with way-finding. Whatever the form, the item should be distinct and easily "imageable".

When developing decoration and signage systems for people with Alzheimer Disease and related disorders, it is especially important that the cues be distinct and easily recognized. To identify spaces, use pictures that relate to the use of the space. For example, a large simple picture of a place setting (plate, knife, fork and spoon) outside the dining room will help people recognize that this is where they will eat. A large simple picture outside a resident's room in a long-term care setting will also help the resident identify his or her own room. Many long-term care settings use a large clear picture of the resident, along with his or her name, on the wall outside the resident's room. This would be suitable, or one may use a picture of something else the resident will be able to recognize and relate to. It is important to work with the individual resident's family to determine what will be especially meaningful and easily recognized by the resident.

Lighting and Glare

A slower and less complete pupillary reflex coupled with the fact that light scatters as it enters the eye of an older person cause difficulties with glare. Highly polished floors are among the worst problems; strong light through windows and shiny metal surfaces are other common sources of glare. The problem can be reduced by:

- using non-shiny flooring or eliminating the process of buffing floors
- effective use of window coverings
- eliminating metal where practical
- using matte finish metals where necessary.

Reduced lighting levels are not an acceptable way to reduce glare, because older people need approximately three times the amount of

light as a younger person to complete the same task. Use flexible and task directed lighting, in which the light is directed at the work surface. Use a broad definition of tasks. For example, walking is a task, and the task surface is the floor. Use even lighting levels throughout, to avoid the visual problems which result from moving between light and dark spaces. Use night lighting to accommodate residents who need to get up during the night. This is especially important for people with Alzheimer Disease who often wander at night.

For people with Alzheimer Disease and related disorders, glare poses not only a problem of safety and discomfort, but also has the potential to cause problems of disorientation. Glare on floors can cause optical illusions which may confuse or disorient individuals with dementia.

Flooring

The type of flooring one uses may have implications for user mobility, glare and a home-like environment. The pattern in the floor may affect orientation and the mobility of the vision impaired. Because many older people walk looking down, the pattern of the flooring needs to be chosen carefully in order to ensure that what people are looking at is not unpleasant and does not cause dizziness or confusion.

There is currently no general agreement on the desirability of using carpets as opposed to other kinds of flooring. Improvements in carpeting have made it more acceptable, because low pile, stain free and odour resistant carpet is now available. However, the question of whether even low pile carpet offers too much resistance to wheelchair users remains to be resolved. Recent research has indicated that carpeting reduces the impact of falls. However, it is possible that carpet also contributes to falls when toes catch on it while walking. This may be of special concern for people with Alzheimer Disease, because many have a shuffling gait.

Furniture

Furniture for the elderly needs to be varied in order to accommodate the heterogeneity of age-related changes in the body. All furniture should be very stable, since older adults often lean on furniture for additional support as they walk. Chairs need to be stable enough to allow users to "drop" into them, and should have hard

seats and arm rests to assist the elderly to rise from them with ease. Corners on all furniture should be rounded.

For the cognitively impaired, the type of furniture can be a powerful cue about how a room is to be used. In planning and designing group settings for people with Alzheimer Disease, it is desirable to use this cueing potential by furnishing spaces so they look like they would be found in a residential setting. Too often lounges contain only chairs, whereas living rooms in homes also contain bookcases, end tables and other items besides chairs.

Personalizing Space

Because a long-term care environment is an individual's home, it is important to allow residents to personalize their rooms. Wide window sills, bookshelves, and bulletin boards make it easier for residents to surround themselves with things that are important to them. Residents should also be allowed to bring their own pillows, afghans, quilts, and even their own furniture, provided it meets size and safety standards established by the facility. Personalizing space helps residents find their own rooms more easily (because it looks distinct and familiar when they look in the door) and creates a less institutional environment. It also helps residents maintain a sense of continuity with their previous lives and a sense of contact with people outside the setting.

For people with Alzheimer Disease, the opportunity to surround themselves with familiar items is especially important because it gives them a sense of security. While the move to a long-term care facility can be particulary disorienting for people with dementia, the presence of familiar items can help reduce some of the negative effects of such a move.

Noise

Background noise should be kept to a minimum in order to assist with concentration and to make the environment more congenial for those with hearing loss. Keep televisions and radios turned off when not in use; make sure fans, air conditioners and similar appliances are well maintained to help keep background noise down. The use of sound absorbing materials such as macrame, hooked rugs, quilts and other kinds of wall hangings can also help in this regard.

Because people with Alzheimer Disease often have short attention spans and are easily distracted, they have difficulty concentrating or focussing their attention. It is especially important to keep back-

ground noise to a minimum in order to help them function at the maximum level of their ability.

Do not use public address systems for announcements or for "easy listening music". It is confusing and disorienting to hear voices coming out of the ceiling. On the other hand, some facilities report that "easy listening music" from a radio or phonograph is calming. For example, one setting reports using it in the dining room before meals, to prevent residents from getting up and leaving before the meal is served.

Texture

Since touch is the sense which shows the least deterioration as people age, texture should be used in environments for the elderly whenever possible to compensate for the lack of stimulation resulting from other sensory losses. Texture can be used on walls (brick, stone or wood), in decoration (hooked rugs, macrame, quilts, etc.), and through the use of interesting fabrics and objects such as plants, sculpture and even pets.

Smell

Like touch, the sense of smell shows relatively less deterioration than other senses and is thought to be the most powerful evoker of memories of all the senses. It can be used as a way-finding cue: the smell of fresh brewed coffee will lead people to the dining room and the smell of fresh baked cookies will help you find the room where the cooking program is being held in a group setting.

Table 8 — Environmental Features Relevant to All Elderly

ENVIRONMENTAL DESIGN FEATURE	FEATURE DESCRIPTION	EXAMPLES OF FEATURE'S USE	REFERENCE
Colour			
Colour therapy	Effective means of controlling and directing behaviour	ARA Living Centres (all over U.S.A.)	Described in D. J. Schultz, 1987
Proper use of colour in decor	Reds, yellows and kelly greens in wallpaper — colours elderly can recognize	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Plants	Add interest and colour	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Coloured Wristband	Colour coded to resident's room colour	No specific location cited	
Contrast			
Floor and wall	To help with mobility; make individual feel more confident	Linhaven, St. Catherines,	
Handrails and the wall	To help with mobility	Linhaven, St. Catherines	
Outline doors	To help with way finding	Linhaven, St. Catherines; Baycrest Home for the Aged, North York	
Handles on drawers and cupboards	To help locate items	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Coloured toilets, bathtub and sinks contrast with floor and wall colours	To help individual bath and toilet independently	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988

Signage and Decoration			
Redundant cueing	Colour and name on door to assist with way finding	Macassa Lodge, Hamilton; Baycrest Home for the Aged, North York	
Wall decorations	Art work, quilts, macrame, rugs to assist with way finding	Baycrest Home for the Aged, North York	
Wall map	Identifying each person's former residence or home town	Baycrest Special Day Program, North York	
Signs	Directions to locations on the unit	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Shelf outside resident's rooms	To place familiar artifacts	Upper Canada Lodge, Niagara-on-the-Lake	
Wall plaque near resident's bedroom	Resident's name and photo to assist with way finding	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Lighting and Glare			
Lighting task-directed	To assist with vision, lighting is directed to the area being used	No specific location cited	
Even light levels	To assist with vision, light should be distributed evenly	No specific location cited	
Night lights	To assist those who get out of bed during the night	No specific location cited	
Non-shiny floors	To reduce glare; if floors cannot be replaced, eliminate buffing and polishing	No spedific location cited	
Window coverings	To prevent sunlight from scattering into the room	Linhaven Home for the Aged, St. Catharines	
Eliminattion of metal	To prevent glare; if this is not practical, use metals with a matte finish	No specific location cited	
Flooring			
Carpet	Plain, low pile, reduces the impact of falls	Wesley Hall, Ann Arbor, Michigan	
Partial carpet (dining room only)	To assist with way finding	Upper Canada Lodge, Niagara-on-the-Lake	

Furniture			
Non-institutional	To create home-like environment	Macassa Lodge, Hamilton	
Square tables	To clearly define individual place settings	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Personalizing Space			
Meaningful items in resident rooms	Furniture, quilts, lamps, bedspreads, photographs	Linhaven, St. Catherines; Island Lodge, Ottawa	
Noise	If TV is used, reroute audio system through a stereo to increase base for clarity	No specific location cited	
Texture			
Wall hangings, carpet, macrame, plants, brick, stone walls	Living areas should contain a variety of textures tcookies or cake from baking program- To provide opportunities for individuals to experience textures	Baycrest Special Day Program, North York	
Smell			
Coffee or food from dining room.	To help individuals locate diningroom	Baycrest Special Day Program, North York	

Environmental Design for Alzheimer Disease

There are some general approaches to designing for people with Alzheimer Disease which, based on the belief that the environment is an element of care, transcend particular behaviours or environments.

1. A Structured Environment

Just as people with Alzheimer Disease require a structured day, they also need a structured and ordered environment. Excess aural and visual stimulation can distract a person from focussing on something they need to do in order to complete a task. For example, if an individual finds hand soap, liquid soap and deodorant soap near the sink when he is trying to wash his hands, he may fail to complete the task because he can't decide which soap to use.

2. A Stable Environment

Changes in the environment are as difficult for a person with dementia as are changes in other areas of life. As the disease progresses, environmental modifications are necessary to improve safety and to help users function better. However, changes should not be made unless there are advantages to doing so. For example, one may think that moving the dishes will make them easier to find, but it is more likely to cause confusion and make them harder to find.

3. Environmental Routines

Try to maintain existing routines that relate to the environment so that particular activities are associated with particular locations. For example, in group settings such as day programs and long-term care facilties, the dining room should only be used for meals and food related activities (birthday parties, afternoon tea) and should not double as an activity room.

4. Environment as Cue

The environment's appearance and structure can serve as a cue about the kinds of behaviours that are expected in a particular space. A bedroom looks different from a dining room — and the presence of the bed is a powerful cue that this is a place to sleep. Even small aspects of the environment can help to cue behaviours. An individual with Alzheimer Disease is more likely to remember to wash his hands if the soap and towel are easily visible.

5. Environment as a Memory Cue

The environment can help the person with Alzheimer Disease deal with memory loss and disorientation. When the individual can no longer remember where the plates go, pictures of the plates on the cupboard they belong in will allow the individual to continue to help put the dishes away.

People with Alzheimer Disease often have good long term memory and enjoy reminiscing about the past. This can be encouraged through the kinds of objects and decorations in the setting. In the home, a group of family pictures may prompt some conversation about the family or about times when the individual was younger. In group settings, old photographs or pictures of historic sites may promote reminiscence among users of the setting.

In addition, some aspects of Alzheimer Disease and related dementias have unique design implications. These include:

- Catastrophic reactions
- Wandering
- Pacing
- Reality Orientation
- Incontinence
- Loss of Judgement

Catastrophic Reactions

Catastrophic reactions may take the form of agitation, outbursts of anger or other ways of reacting to fear, frustration and confusion. There are no environmental design features specifically designed to prevent catastrophic reactions. However, to the extent that it arouses negative emotions, the environment can contribute to their occurrence and, therefore, it should be designed to be humane and responsive.

One environmental feature which does relieve catastrophic reactions is a quiet room where an individual can go with a caregiver to calm down and to relax following a reaction.

Wandering

Many people with Alzheimer Disease have a propensity to wander, seemingly in search of some other, better place. Environments must be secure to prevent wanderers from leaving an area and getting lost. Until recently, this was dealt with by locking the area, using a standard lock which could be opened by a key. Improvements in technology have made possible more sophisticated, subtle and humane approaches which ensure that what the individual must do to leave the area is beyond his or her intellectual or physical capabilities.

The most common solution is a lock which is released by pressing a pre-determined combination of numbers in a given order. Often the task is made more difficult by requiring that two numbers be pressed simultaneously, followed by a third number. Since most people with Alzheimer Disease or a related disorder will be unable to do this, the instructions on how to operate the lock can be posted next to the door. At the Philadelphia Geriatric Centre, one must reach around a post and push inwards on a button, while pushing outwards on the Dutch door to open it. Because the button is invisible and the task is too complex, this system is successful in preventing people from leaving the unit.

A very simple and inexpensive approach to controlling wandering involves placing something on the floor which appears to be a barrier. This could be rows of masking tape or a wide dark strip. An equally simple approach involves placing the lock high up or low down on the door, on the basis that the wanderer is unlikely to think to look for a lock in those places.

Of course, none of these solutions is absolutely foolproof. Even the traditional lock and key system may not prevent residents from leaving an area when the person with the key opens the door to allow someone else to leave.

A more high-tech solution involves an alarm system similar to those used by stores to control shoplifting. Individuals who have been identified as wanderers wear a piece of jewelry, such as a bracelet, which contains an electronic chip which sets off the alarm. However, the technology will not be effective without a person who monitors the alarm system and is prepared to act when the alarm goes off.

Given the fallibility of each of these systems, some facilities use procedures which are intended to make it easier to find an individual who has wandered away. This may be as simple as a distinctive t-shirt in a bright colour which alerts people to return the individual to a

facility, or it may be as complex as a wanderer wearing an electronic chip which allows him or her to be tracked up to several miles away.

Pacing

Pacing is a common behaviour among people with Alzheimer Disease, although the reasons for it are not clear. Since it seems to discharge energy and channel restlessness, it is generally agreed that the best way to deal with pacing is to accommodate it.

One must not only provide space for pacing, but also make it interesting and stimulating. The preferred approach is to design a space, such as a racetrack or a figure eight, in which the pacer never comes to the end of a hall. The least desirable pacing spaces are those which end with turns into dead end spaces. A single corridor is not a very desirable solution, but it can be improved by providing interesting spaces at either end of the hall. All spaces for pacing would benefit from added interest along the way — a lounge, a sitting nook or even some wall decorations.

Reality Orientation

Reality Orientation refers to a therapeutic approach to relating to people with Alzheimer Disease. Although it now has far less currency than it did when first introduced, it continues to be an element to consider in environmental design.

Reality Orientation boards contain basic information (the day, the date, the name of the facility) to assist long term care residents to orient themselves to time and place. If the setting uses a Reality Orientation program, these boards should be provided in spaces where sessions take place, as well as in a generally accessible space such as near the nursing station. Locating easy-to-read clocks and calendars throughout the setting will also help users orient themselves to time.

A more subtle, but equally important, form of Reality Orientation involves ensuring that the environment is as it appears to be, and that it does not "play tricks" on the viewer. This principle is based on the belief that people with dementia retain some expectations about what things should be like, and that their accurate views of reality should be reinforced. Some of the more dramatic examples which violate this concept include:

- wallpaper which looks like brick or stone, but lacks the feel of these interesting textures

- plastic plants and flowers which do not "behave" like real plants — they feel differently, they do not die, grow or change, they do not smell, and are all together disconfirming of reality
- murals, often found on end walls of long corridors — the scene in the mural does not change with the time of day, and presents a different reality than one sees when looking out a window (e.g., the individual looks out a window to see a sunny and snowy urban scene while the mural indicates an autumnal sunset in the mountains).

Incontinence

Not all people who are incontinent have Alzheimer Disease but all people with Alzheimer Disease become incontinent in the middle to late stages of the disease. Environmental design should make it easy for users to get to and use the bathroom. Bathrooms should be located near the impaired person, wherever he or she may be. As well, they should be easily accessible and easy to see; they should not be hidden away in a corner. One facility placed a red awning over the door to the bathroom. The awning projects into the corridor, making it easy to see from almost anywhere on the unit. Large clear pictures on the door will help distinguish between the men's and womens' washrooms.

Within the bathroom, use coloured fixtures to provide the contrast that makes the bathroom easier to "read". Wall mounted toilets will make it easier to clean urine from the floor.

Because some residents will be unable to make it to the bathroom, the environment must be one that is easily cleaned. However, this does not necessarily mean that all surfaces must be smooth, cold and institutional. While you may wish to avoid fabric seat cushions, there are some vinyls with interesting patterns and pleasant textures. Seat backs do not need to be vinyl.

Loss of Judgement

The loss of judgment which accompanies Alzheimer Disease and related disorders means that there are a number of miscellaneous but important safety issues in the environment that must be addressed.

Restrict access to products which are dangerous if swallowed (medications, cleaning supplies, paints, kerosene, etc.) and any which are corrosive or otherwise harmful to the skin.

Restrict access to sharp items such as knives, scissors, razor blades, or paper cutters and to tools with sharp points or edges, such as saws, drills and screwdrivers.

Traffic areas should be free of any hidden obstacles such as chair legs that extend beyond the seat. All visual ambiguities and optical illusions should be avoided.

Reduce the temperature on the hot water heater or install an anti-scalding device so the individual will not scald himself or herself, and cover exposed radiators and other heat producing sources.

Fix the stove so that the person with Alzheimer Disease cannot use it without supervision. In a group setting such as a day program or long term care facility, the stove might be located in a kitchen to which access is restricted, perhaps through a lock on the kitchen door. Other ways to restrict access include removing fuses and installing a switch which must be released before the stove can be turned on.

Restrict access to stairs so people with Alzheimer Disease do not use them unless a caregiver is present. In group settings, the Fire Marshall will often have standards about access to stairs; in homes, put gates at the top and bottom of the stairs.

Remove locks from room doors (bathroom, bedroom) so the person with Alzheimer Disease cannot lock herself or himself in.

Physical Layout in a Long-Term Care Setting

Preferred layouts for long-term care settings for people with Alzheimer Disease should help create a non-institutional and home-like environment. A hierarchical approach to space with resident rooms in small clusters (preferably a maximum of 12 residents per cluster) is a common design solution. Each cluster should have its own dining room, activity room and lounge/living room.

In units for people in the moderate stages of the disease, it is desirable to locate a kitchen on the unit so residents may participate in baking and cooking programs. The conventional wisdom seems to be that private rooms are preferable for people with Alzheimer Disease and related disorders, although there is no empirical evidence to support this.

Table 9 — Environmental Features Relevant to Cognitively Impaired Elderly

ENVIRONMENTAL DESIGN FEATURE	FEATURE DESCRIPTION	EXAMPLES OF FEATURE'S USE	REFERENCE
Structured Environment	Reducing levels of complexity and stimulation	Oaknoll Retirement Residence, A Reduced Stimulation Unit	Found positive changes in levels of agitation Described in A.T. Cleary et. al, 1988
Stable Environment	Reducing changes in the environment	No specific location cited	
Environmental Routines	Maintaining existing routines so that activities are associated with locations	No specific location cited	
Environment as cue	Environment's appearance can cue types of behaviours expected in a particular space	No specific location cited	
Environment as a Memory Cue	Examples include: pictures of plates on the cupboard or of the socks on the drawer where they belong	No specific location cited	
Catastrophic Reactions			
Time-out Room	To calm down an agitated individual	Baycrest Special Day Program, North York	
Wandering			
Alarms	Placed on all exit doors	Morningside House, New York	
Other complex unlocking mechanisms	Placed in strategic places	Weiss Institute, Philadelphia Geriatric Center, Philadelphia	

Wandering (cont.)			
Pictures of wanderers	Placed at front desk in entrance lobby	Morningside House New York	
Coil embedded in rubber strapped to ankle of wanderer	Alarm goes off if wanderer walks through wrong door	Morningside House New York	
Number pad system to lock door	Task too difficult for impaired to master	Macassa Lodge, Hamilton; Wentworth Lodge, Dundas; Baycrest Special Day Program, North York; St. Joseph's Villa, Dundas	
Accommodate as a normal activity via therapeutic park and safe wandering areas indoors and out	Used for stimulation and distraction	Linhaven, St. Catherines; Sunset Haven, Welland; Upper Canada Lodge, Niagara-on-the-Lake; Gilmore Lodge, Fort Erie; Dorchester Manor, Niagara Falls; Northland Manor, Port Colborne	
Special shirts and sweaters worn by those at risk of wandering	To be able to spot a lost person	Sunnybrook Medical Centre, Toronto	
Strips of masking tape on floor	Appears as a barrier	Terrell State Hospital, Terrell, TX	Not effective for all residents, but some improvement at a very low cost. Described in M.P. Calkins, 1988 and in Hussian, 1987
Pacing			
Racetrack or figure eight	Created so that person never comes to the end of the hall	Corinne Dolan Alzheimer's Centre, Chardon, OH	Described in M.P. Calkins, 1988
Short corridors	Not more than 50 to 75 feet in length	Florence Hand Home, LaGrange, Georgia	
Interactive wall art	Provide interesting stimulation along the pacing path	Veterans Home, Iowa City	Described in M.P. Calkins, 1988
Shared living rooms at the ends of pacing paths	Encourages interaction with other residents	Rocky Knoll, Plymouth, WI	Described in M.P. Calkins, 1988

Reality Orientation			
Reality Orientation Board	Records date, weather and time	Morningside House New York; Weiss Institute, Philadelphia Geriatric Center, Philadelphia	
Large Clock	To help orient	Morningside House New York	
Calendars	To help orient	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Incontinence			
Awnings over bathroom doors	To help locate bathroom	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Directional signs at strategic places	To help locate bathroom	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988
Area Layout			
Cluster plan	Four to six rooms clustered together with a central living space in between	The Washington Home, Washington, DC	Described in M.P. Calkins, 1987 and 1988
Pavilion design	Central open area with resident rooms arranged around edge	Weiss Institute, Philadelphia Geriatric Center, Philadelphia	Evaluated in B. Liebowitz, 1979; M. P. Lawton, 1984
General Safety Considerations			
Fire regulations	Monitoring of stairwells and elevators; hand rails; rounded corners	Required in all Ontario Homes	
Safety switches on stoves	Turns stove off automatically or does not allow individual to turn stove on	Wesley Hall, Ann Arbor, Michigan	Described in A. Robinson, 1988

Discussion

In both a home and an institutional setting, it is possible to make minor, inexpensive modifications to the environment to help people with Alzheimer Disease and related dementias function at the maximum level of their ability — within the constraints of their mental and physical condition. Unlike some aids and devices, environmental adaptations do not depend on the ability of the individual to master new skills. However, effective environmental design does rely on the ability of the caregiver to assess the patient's abilities and deficits and to shape the living area to suit the individual. Again, a number of modifications to the environment must be adjusted as the disease progresses.

Conclusion

This document has reviewed technologies and environmental adaptations that are available to assist persons with dementias in coping with activities of daily living. The approaches range in sophistication from the simple use of colours to guide someone to an appropriate room to complex tracking systems for monitoring people who wander. There are a number of conclusions that can be drawn about the use of technology to assist persons with dementia:

- the complexity and progressiveness of the diseases necessitates frequent reassessment, and the utility of technologies and certain environmental adaptations are limited to specific stages of the disease process;
- technologies must be matched to individual needs;
- simple, low cost technologies and environmental modifications are often appropriate;
- most technologies and environmental adaptations help the caregiver to provide care, but do not replace the caregiver; and
- technology and environmental design can be useful in both home and institutional settings.

The research literature on the management of dementia in the elderly typically does not present a differentiated view of the disease process. Many diseases are lumped together under the label of Alzheimer Disease thus obscuring a comprehensive understanding of the effectiveness of different approaches to care. Few systematic evaluations of interventions have been were reported.

There is a need to bring technologists and clinicians together to educate both groups about the potential benefits of technology and environmental modifications in the care of individuals with dementia. Technologists need to have a better understanding of how dementia affects activities of daily living and clinicians must learn how technology can affect their practice. Working together, technologists and clinicians can adapt existing technologies — such as those developed for the disabled — or develop new devices specifically designed for persons with dementia. Further research and product development is needed to meet the future demands of our aging population.

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Appendix

Classification of Dementia

1. **Cortical dementias**
   - Alzheimer disease
   - Pick disease

2. **Subcortical dementias**
   - Parkinson disease
   - Huntington disease
   - Progressive supranuclear palsy
   - Wilson disease
   - Spinocerebellar degenerations
   - Idiopathic basal ganglia calcification

3. **Dementias with cortical and subcortical dysfunction**
   - Multi-infarct dementias

4. **Hydrocephalus**

5. **Toxic and metabolic encephalopathies**
   - Systemic illnesses
   - Endocrinopathies
   - Deficiency states
   - Drug intoxications
   - Heavy metal exposure
   - Industrial dementias

6. **Infectious dementias**
   - Slow virus dementias
   - General paresis

7. **Miscellaneous dementia syndromes**
   - Posttraumatic
   - Postanoxic
   - Neoplastic

8. **Dementia syndrome of depression**

Characteristics of Cortical and Subcortical Dementias

Characteristic	Cortical dementia	Subcortical dementia
Verbal output		
Language	Aphasic	Normal
Speech	Normal	Abnormal (hypophonic, dysarthric, mute)
Mental status		
Memory	Amnesia (learning deficit)	Forgetful (retrieval deficit)
Cognition	Abnormal (acalculia, poor judgment, impaired abstraction)	Abnormal (slowed, dilapidated)
Affect	Abnormal (unconcerned or disinhibited)	Abnormal (apathetic or depressed)
Motor system		
Posture	Normal*	Abnormal (stooped, extended)
Tone	Normal*	Usually increased
Movements	Normal*	Abnormal (tremor, chorea, asterixis, dystonia)
Gait	Normal*	Abnormal

*Motor system impairment develops in the final stages of the cortical dementias.

Adapted from Cummings and Benson, 1983.